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AJNR Am J Neuroradiol 1983, 4 (3) 609-610

<http://www.ajnr.org/content/4/3/609>

This information is current as
of April 19, 2024.

Computed Air Myelography of the Lumbosacral Spine

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Plain computed tomography (CT) of the lumbosacral spine may be a reliable method for diagnosing herniated disk when abundant epidural fat is present. When epidural fat is not sufficient, CT after the administration of nonionic contrast medium (170 mg I/ml) and/or regular metrizamide myelography have been used. Ten patients were studied by CT enhanced with air injected as a negative contrast agent. The findings were correlated with plain and contrast-enhanced (metrizamide) CT as well as conventional myelography. The technique is described and advantages and disadvantages of the method are discussed. Air-contrast CT is useful in the evaluation of herniated disk in cases with equivocal findings on plain CT and in patients with a history of allergic reaction to iodinated contrast media.

Computed tomography (CT) is commonly used after routine plain radiography of the lumbosacral spine in the evaluation of low back pain. Enhancement of CT with intrathecal injection of positive contrast material, as introduced by DiChiro and Schellinger [1], allows visualization of more anatomic detail in the spinal canal. We will evaluate the usefulness of and indications for CT enhanced with air injected as a negative contrast agent in the study of herniated or bulging disk at the lumbosacral level.

Subjects and Methods

Ten patients were studied. Lumbar puncture was performed with a 19 gauge needle at the L3-L4 interspace under local anesthesia

and aseptic conditions. A 2 French catheter with two side holes near its end, marked in 5 cm increments, was advanced through the needle into the subarachnoid space. The needle was then withdrawn and the catheter taped to the chest wall. The patient was placed on the imaging table seated on a 6 or 7 inch (15.2-17.8 cm) thick pad, then put into a reclining position. This maneuver was intended to facilitate optimal axial scans through the intervertebral spaces at L3-L4, L4-L5, and L5-S1. Eight ml of air was injected and a scout lateral digital radiograph of the lumbosacral spine was obtained. If the air column in the subarachnoid space did not extend up to the L3 level, more air was injected and another scout view was obtained. Four consecutive slices, each 5 mm thick, were obtained at each of the lower three lumbar disk spaces using a GE CT/T 8800 scanner. At the end of the study air was removed through the indwelling catheter. The patient was then transferred to the myelographic table, where metrizamide myelography was performed after injecting the contrast medium through the catheter. Repeat CT scans at the disk levels were obtained about 6 hr later.

Results

The findings in 10 cases are summarized in table 1. Four patients (cases 1-4) had normal studies (fig. 1). One patient (case 5) had a bulging disk demonstrated by air CT and air myelography. Five patients had herniated disks. Of these, two (cases 8 and 9) had herniations at the L5-S1 level that were not detected on metrizamide myelography. One patient (case 10) had a herniated disk at L5-S1 that was not visible on plain CT but was demonstrated by air

TABLE 1: CT and Myelographic Findings in 10 Patients Evaluated for Lumbar and Lumbosacral Disk Herniation

Case No.	CT			Myelography	Level	Findings
	Plain	Air	Metrizamide			
1	N	N	N	N	...	Normal
2	N	N	N	N	...	Normal
3	N	N	N	N	...	Normal
4	...	N	...	N*	...	Normal
5	...	+	...	+	L4-L5	Bulging disk
6	+	+	+	+	L4-L5	Herniation
7	+	+	+	+	L5-S1	Herniation
8	+	+	+	N	L5-S1	Herniation
9	+	+	+	N	L5-S1	Herniation
10	N	+	+	+	L5-S1	Herniation

Note.—N = normal; + = positive.

* Air myelography.

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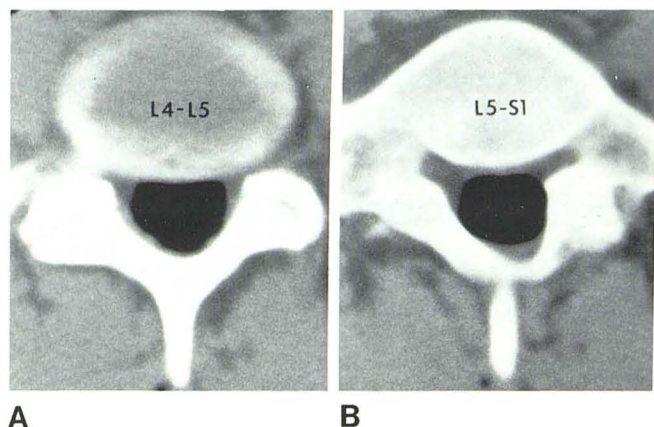


Fig. 1.—Normal case. Air CT at L4-L5 (A) and L5-S1 (B) disk levels. Air fills subarachnoid space and abuts posterior margins of disks. Root sleeves are not visualized.

and metrizamide CT and metrizamide myelography (fig. 2). One patient complained of severe headache. In this patient we injected 20 ml of air with a 22 gauge spinal needle. The air ascended into the head and was distributed in the intracranial subarachnoid spaces. There were no other adverse effects observed.

Discussion

Our study was stimulated by two patients (cases 4 and 5) who reported a history of severe allergic reaction to previous urography and by our desire to have contrast enhancement in the subarachnoid space during CT scanning for the evaluation of herniated lumbar disk. By using the technique described, the patient can be moved into the proper position on the CT table and air injection can be postponed until the patient is ready for scanning. This prevents the possible ascent of air from the lumbar region into the cranium. Through the indwelling catheter air can be injected in fractional amounts to the extent and level needed. At the end of the study air can be withdrawn easily through the indwelling catheter, thus minimizing the residual amount and avoiding unnecessary headache.

We found air to be a satisfactory contrast material which in a normal patient reaches the posterior aspects of adjacent vertebral bodies and the posterior margins of the disks with the patient in supine scanning position (fig. 1). When there is a herniated disk the air column in the thecal sac appears asymmetric, deformed or narrow and displaced, or remains unfilled (fig. 2). In contrast to metrizamide CT studies, the air does not appear to fill the root sleeves. This may be attributable to surface tension of the cerebrospinal fluid (CSF). This is a disadvantage in comparison with metrizamide, which diffuses into the CSF and allows visualization of the

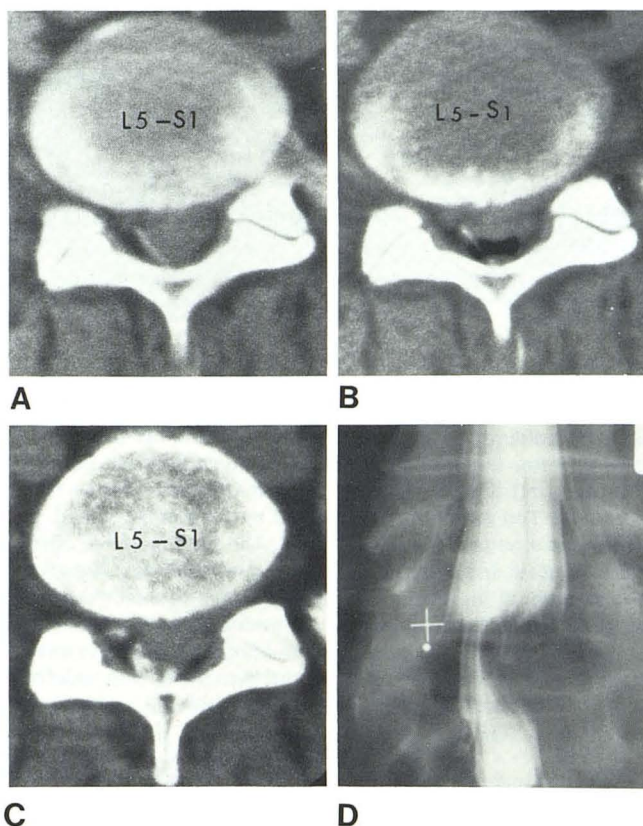


Fig. 2.—Case 10. A, plain CT at L5-S1 disk level shows asymmetry of thecal sac but fails to demonstrate herniated disk. B, Air CT. Air column in thecal sac is deformed and displaced posteriorly, outlining soft-tissue mass. C, Metrizamide-enhanced CT. Thecal sac is narrowed and displaced posteriorly by large herniated disk. Right root sleeve is visualized. D, Metrizamide myelography demonstrates severe herniation at L5-S1 disk level.

root sleeves. However, air has the advantage of eliminating the potential risks of seizure or allergic reaction apart from other minor side effects. Another important consideration is the lack of expense when air is used as the contrast medium.

REFERENCE

1. DiChiro G, Schellinger D. Computed tomography of spinal cord after lumbar intrathecal introduction of metrizamide (computer-assisted myelography). *Radiology* 1976;120:101-104